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(54) **BATTERY PACK**

BATTERIEPACK

BLOC-BATTERIE

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a battery pack.

BACKGROUND ART

[0002] In general, secondary batteries refer to batteries that can be repeatedly charged and recharged unlike non-rechargeable primary batteries. Secondary batteries are used as energy sources of devices such as mobile devices, electric vehicles, hybrid vehicles, electric bicycles, or uninterruptible power supplies. Secondary batteries are individually used or secondary battery modules (battery packs) each including a plurality of secondary batteries connected as one unit are used according to the types of external devices using secondary batteries.

[0003] Unlike small mobile devices such as cellular phones each operable for a certain period of time using a single battery, devices such as electric vehicles or hybrid vehicles having long operation times and consuming large amounts of electricity may prefer battery modules (battery packs) each including a plurality of batteries to handle problems relating to power and capacity, and the output voltages or currents of battery modules may be increased by adjusting the number of batteries included in each battery module. US2013149583 discloses a battery casing in which the bottom portion of the battery casing is provided with a port that allows cooling air into the casing.

DESCRIPTION OF EMBODIMENTS

TECHNICAL PROBLEM

[0004] An embodiment of the present disclosure includes a battery pack improved in heat dissipation efficiency by using a liquid cooling medium contained to face different surfaces of the battery pack.

[0005] An embodiment of the present disclosure includes a battery pack configured to realize high heat dissipation efficiency with relatively low costs through a simple high-efficiency heat dissipation structure.

SOLUTION TO PROBLEM

[0006] A battery pack of the present disclosure includes:

a battery cell including a terminal surface on which an electrode terminal is formed, a bottom surface which is opposite the terminal surface, and a lateral surface which is between the terminal surface and the bottom surface;
a first tank which faces the terminal surface of the battery cell;
a second tank which extends from the first tank and faces the lateral surface of the battery cell; and
a third tank which extends from the second tank and faces the bottom surface of the battery cell,
wherein a cavity is formed in the first and second tanks to extend across the first and second tanks, and the cavity is filled with a first cooling medium and is fluidically isolated from outside of the battery pack, and
a flow path is formed in the third tank to receive a flow of a second cooling medium which is different from the first cooling medium. The invention is given by the claims.

ADVANTAGEOUS EFFECTS OF DISCLOSURE

[0007] According to the present disclosure, battery cell cooling efficiency may be improved by using cooling media which are contained in first to third tanks to face different surfaces of battery cells, and realizing a fluid cooling system with a cooling medium having a relatively high heat capacity.

[0008] According to the present disclosure, since a cooling medium contained in the first and second tanks relatively close to electrode terminals are allowed to naturally convect at a relatively low flow speed or dissipate heat in a static state in which the flow speed of the cooling medium is substantially zero, it may be unnecessary to provide a duct structure for introducing or discharging the cooling medium or a fluid pump for forcing the cooling medium to circulate. Therefore, heat dissipation efficiency may be improved using the cooling medium having a relatively high heat capacity while decreasing the possibility of a short circuit at the electrode terminals caused by leakage or accumulation of the cooling medium, and high heat dissipation efficiency may be realized with low costs owing to simplification in structure.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

FIG. 1 is a perspective view illustrating a battery pack according to a preferred embodiment of the present disclosure.
FIG. 2 is an exploded perspective view illustrating the battery pack illustrated in FIG. 1.
FIG. 3 is a perspective view illustrating a battery cell illustrated in FIG. 1.
FIG. 4 is a cross-sectional view taken along line IV-IV of FIG. 1.
FIG. 5 is an enlarged view illustrating a portion of FIG. 4.

BEST MODE

[0010] A battery pack of the present disclosure includes:

a battery cell including a terminal surface on which an electrode terminal is formed, a bottom surface which is opposite the terminal surface, and a lateral surface which is between the terminal surface and the bottom surface;

a first tank which faces the terminal surface of the battery cell;

a second tank which extends from the first tank and faces the lateral surface of the battery cell; and

a third tank which extends from the second tank and faces the bottom surface of the battery cell,

wherein a cavity is formed in the first and second tanks to extend across the first and second tanks, and the cavity is filled with a first cooling medium and is fluidically isolated from outside of the battery pack, and

a flow path is formed in the third tank to receive a flow of a second cooling medium which is different from the first cooling medium.

[0011] For example, the cavity may extend through a boundary region between the first and second tanks to allow a fluid to flow between the first and second tanks.

[0012] For example, the cavity of the first and second tanks and the flow path of the third tank are isolated from each other.

[0013] For example, a heat conduction block may be provided between the cavity of the first and second tanks and the flow path of the third tank.

[0014] For example, the heat conduction block is not provided with a space for storing a fluid.

[0015] For example, an inlet for introducing the second cooling medium and an outlet for discharging the second cooling medium are formed in the third tank.

[0016] For example, an average flow speed of the first cooling medium is less than an average flow speed of the second cooling medium.

[0017] For example, the first cooling medium may have a heat capacity greater than a heat capacity of the second cooling medium.

[0018] For example, the first and second tanks may be connected to each other through a first bent portion and may extend in different directions from the first bent portion to respectively face the terminal surface and the lateral surface of the battery cell.

[0019] For example, the cavity may extend through the first bent portion and may fluidically connect the first and second tanks to each other.

[0020] For example, the second and third tanks may be connected to each other through a second bent portion and may extend in different directions from the second bent portion to respectively face the lateral surface and the bottom surface of the battery cell.

[0021] For example, a heat conduction block may be provided between the cavity of the second tank and the flow path of the third tank, and the heat conduction block may include the second bent portion and may extend across the second bent portion.

[0022] For example, the first tank may be formed in a region outside a pair of electrode terminals.

[0023] For example, the cavity

may have a width which is uniform in the first tank and is nonuniform in the second tank.

[0024] For example, the width of the cavity may gradually decrease from an upper position of the second tank which is close to the first tank toward a lower position of the second tank which is close to the third tank.

[0025] For example, the second tank may include an inner wall facing the lateral surface of the battery cell and an outer wall which is opposite the lateral surface of the battery cell, and

[0026] a thickness of the second tank which is defined between the inner wall and the outer wall may be constant from the upper position close to the first tank to the lower position close to the third tank.

[0027] For example, a first thickness defined between the cavity and the inner wall may be constant from the upper position close to the first tank to the lower position close to the third tank, and

a second thickness defined between the cavity and the outer wall may gradually increase from the upper position close to the first tank to the lower position close to the third tank.

[0028] For example, the cavity of the second tank

may have a triangular cross-section with a hypotenuse which obliquely extends from a vertex located at the upper position close to the first tank to a vertex located at the lower position close to the third tank such that the width of the cavity may gradually decrease from the upper position to the lower position.

[0029] For example, the first to third tanks may extend as one part.

MODE OF DISCLOSURE

[0030] Hereinafter, a battery pack will now be described according to preferred embodiments of the present disclosure with reference to the accompanying drawings.

[0031] FIG. 1 is a perspective view illustrating a battery pack according to a preferred embodiment of the present disclosure. FIG. 2 is an exploded perspective view illustrating the battery pack shown in FIG. 1. FIG. 3 is a perspective view illustrating a battery cell illustrated in FIG. 1. FIG. 4 is a cross-sectional view taken along line IV-IV of FIG. 1. FIG. 5 is an enlarged view illustrating a portion of FIG. 4.

[0032] Referring to the drawings, the battery pack may include: a plurality of battery cells 10; and first, second, and third tanks T1, T2, and T3 which surround the battery cells 10. The first, second, and third tanks T1, T2, and T3 may be arranged around the battery cells 10 and may dissipate heat from the battery cells 10 at different positions around the battery cells 10, and for dissipating heating from the battery cells 10, the first, second, and third tanks T1, T2, and T3 may accommodate cooling media having high heat capacities. As described later, the first, second, and third tanks T1, T2, and T3 may dissipate heat from the battery cells 10 by a liquid cooling method using first and second cooling media F1 and F2 which have relatively high heat capacities instead of using gases such air.

[0033] The first, second, and third tanks T1, T2, and T3 may be formed in one piece to have a continuous structure. For example, the first, second, and third tanks T1, T2, and T3 may be formed as one part through, for example, one process such as a high-pressure die casting process instead of forming the first, second, and third tanks T1, T2, and T3 as individual parts and then combining the first, second, and third tanks T1, T2, and T3 with each other.

[0034] In particular, each pair of the first and second tanks T1 and T2 may share one cavity C (refer to FIG. 4) that is continuously formed, and to prevent leakage of the first cooling medium F1 (refer to FIG. 4) filled in the cavity C (refer to FIG. 4), each pair of the first and second tanks T1 and T2 may be formed as one part to maintain the fluid tightness of the cavity C (refer to FIG. 4). Since the first and second tanks T1 and T2 are positioned relatively close to electrode terminals 15 at which charge-discharge current is concentrated, it is needed to tightly seal the first cooling medium F1 (refer to FIG. 4) to prevent a short circuit caused by leakage of the first cooling medium F1 (refer to FIG. 4), and thus at least the first and second tanks T1 and T2 may be continuously connected to each other in a seamless form without any joints therebetween.

[0035] The first and second tanks T1 and T2 may be connected to each other with first bent portions B1 as boundaries therebetween, and may extend in different directions from the first bent portions B1 to face different surfaces of the battery cells 10. Similarly, the second and third tanks T2 and T3 may be connected to each other with second bent portions B2 as boundaries therebetween, and may extend in different directions from the second bent portions B2 to face different surfaces of the battery cells 10.

[0036] Referring to FIG. 3, each of the battery cells 10 may include: a terminal surface 10U on which electrode terminals 15 are formed; a bottom surface 10L which is opposite the terminal surface 10U; main surfaces 10M which extend between the terminal surface 10U and the bottom surface 10L and having a relatively large area; and lateral surfaces 10S which extend between the terminal surface 10U and the bottom surface 10L and having a relatively small area.

[0037] Each of the battery cells 10 may be formed in a substantially rectangular parallelepiped shape including a terminal surface 10U, a bottom surface 10L, a pair of main surfaces 10M, and a pair of lateral surfaces 10S. The battery cells 10 may be arranged in one direction, and in this case, the main surfaces 10M of neighboring battery cells 10 may face each other.

[0038] The first, second, and third tanks T1, T2, and T3 may surround the terminal surfaces 10U, the bottom surfaces 10L, and the lateral surfaces 10S between the terminal surfaces 10U and the bottom surfaces 10L, that is, may surround four different surfaces 10U, 10S, and 10L except the main surfaces 10M which face each other in the arrangement direction of the battery cells 10.

[0039] The first, second, and third tanks T1, T2, and T3 may be formed in one piece, and since the first, second, and third tanks T1, T2, and T3 surrounding the four different surfaces 10U, 10S, and 10L of the battery cells 10 are formed in one piece, structures for joining individual members may not be required, thereby guaranteeing simplicity in structure.

[0040] The assembly of the battery pack will be described below with reference to FIG. 2. That is, the first, second, and third tanks T1, T2, and T3 formed in one piece to surround the four different surfaces 10U, 10S, 10L except the main surfaces 10M which face each other in the arrangement direction of the battery cells 10 may first be prepared; the battery cells 10 may be assembled by sliding the battery cells 10 in one direction (corresponding to the arrangement direction) into the first, second, and third tanks T1, T2, and T3 that are open in the direction (corresponding to the arrangement direction); and a pair of end plates (not shown) may be placed on one open end and the other open end of the first, second, and third tanks T1, T2, and T3 in the direction (corresponding to the arrangement direction) as finishing member for the open ends of the first, second, and third tanks T1, T2, and T3.

[0041] Referring to FIGS. 4 and 5, the first tanks T1 may be arranged to face the terminal surfaces 10U of the battery cells 10. Since charge-discharge current is concentrated on the terminal surfaces 10U of the battery cells 10, and the electrode terminals 15 connected to electrode assemblies (not shown) provided inside the battery cells 10 are formed on the terminal surfaces 10U, the generation of heat may be concentrated on the terminal surfaces 10U of the battery cells 10, and thus it may be required to dissipate heat mainly from the terminal surfaces 10U of the battery cells 10. The first tanks T1 may be arranged to face the terminal surfaces 10U of the battery cells 10 and dissipate heat from the terminal surfaces 10U of the battery cells 10 at a close distance.

[0042] A pair of electrode terminals 15 facing each other may be formed on the terminal surface 10U of each of the battery cells 10, and the first tanks T1 may be arranged outside the pair of electrode terminals 15. For example, the first tanks T1 may not entirely cover the terminal surface 10U of each of the battery cells 10, but may cover a portion of the terminal surface 10U, that is, only outer regions of the terminal surface 10U. Since the first tanks T1 selectively cover the outer regions of the terminal surface 10U as described above, the pair of electrode terminals 15 may be exposed from the first tanks T1 in an inner region of the terminal surface 10U, and bus bars (not shown) may be coupled to the exposed electrode terminals 15 to electrically connect the electrode terminals 15 with electrode terminals 15 of adjacent battery cells 10.

[0043] The first tanks T1 may extend from inner positions PI relatively adjacent to the electrode terminals 15 to outer positions PO relatively distant from the electrode terminals 15, and the cavities of the first tanks T1 may have a uniform width W1 (refer to FIG. 5) from the inner positions PI to the outer positions PO. In this case, the width W1 of the cavities C of the first tanks T1 may be measured in a direction perpendicular to the terminal surface 10U of each of the battery cells 10 which face the first tanks T1.

[0044] Since the first tanks T1 are arranged to face the terminal surfaces 10U requiring dissipation of a relatively large amount of heat and have relatively small lengths limited within the outer regions of the battery cells 10 so as not to cover the electrode terminals 15, it is preferable that the first cooling medium F1 be contained in the cavities C in a sufficient amount for coping with heat dissipation requirements, and the cavities C of the first tanks T1 may have a uniform width W1 from the inner positions PI close to the electrode terminals 15 to the outer positions PO distant from the electrode terminals 15. When the cavities C of the first tanks T1 have a nonuniform width W1, heat may be poorly dissipated in a region in which the width W1 is relatively small because of an insufficient amount of the first cooling medium F1.

[0045] The first tanks T1 are responsible for dissipation of heat from the terminal surfaces 10U of the battery cells 10 at positions close to the terminal surfaces 10U of the battery cells 10. As described later, the first, second, and third tanks T1, T2, and T3 are thermally connected to each other and cooperate with each other for dissipating heat from the battery cells 10, and heat of the terminal surfaces 10U may be transferred to the second and third tanks T2 and T3 through the first tanks T1 closest to the terminal surfaces 10U and may then be finally dissipated to the outside of the battery pack through the third tank T3.

[0046] The second tanks T2 may be arranged to face the lateral surfaces 10S of the battery cells 10. The second tanks T2 may extend through the first bent portions B1 from the first tanks T1 facing the terminal surfaces 10U of the battery cells 10 to face the lateral surfaces 10S of the battery cells 10. The second tanks T2 may be arranged to face the lateral surfaces 10S of the battery cells 10 and may dissipate heat from the lateral surfaces 10S of the battery cells 10 at a close distance from the lateral surfaces 10S of the battery cells 10.

[0047] Each of the second tanks T2 may share one cavity C with one first tank T1, and the cavities C may extend across the first and second tanks T1 and T2 to fluidically connect the first and second tanks T1 and T2 to each other. For example, the cavities C may extend through the first bent portions B1 forming boundary regions between the first and second tanks T1 and T2 to fluidically connect the first and second tanks T1 and T2 to each other and thus to allow a fluid to flow between the first and second tanks T1 and T2. In the present specification, the expression "the cavities C extend across the first and second tanks T1 and T2," or "the cavities C extend through the first and second tanks T1 and T2" may mean that the cavities C fluidically connect the first and second tanks T1 and T2 through the boundaries between the first and second tanks T1 and T2.

[0048] The first cooling medium F1 filled in the cavities C may allow direct heat transfer between the first and second tanks T1 and T2 while moving in the cavities C by natural convection. For example, since the first and second tanks T1 and T2 are fluidically connected to each other, natural convection in the first tanks T1 and natural convection in the second tanks T2 may affect each other, and this may mean that: natural convection in the first tanks T1 and natural convection in the second tank T2 may come into direct contact with each other or mix with each other to result in heat exchange; or heat transfer may occur between the first and second tanks T1 and T2 by natural convection of the first cooling medium F1 filled in the cavities C extending through the first and second tanks T1 and T2.

[0049] Since the first tanks T1 face the terminal surfaces 10U on which heat is concentrated, the first tanks T1 may absorb heat from the terminal surfaces 10U at a close distance from the terminal surfaces 10U, and the first cooling medium F1 which has absorbed heat from the terminal surfaces 10U may transfer the heat to the second tanks T2 by natural convection. The first and second tanks T1 and T2 may be connected to each other through the first bent portions B1 and may extend in different directions from the first bent portions B1 to respectively face the terminal surfaces 10U and the lateral surfaces 10S of the battery cells 10. In this case, the cavities C of the first and second tanks T1 and T2 may penetrate the first bent portions B1 to fluidically connect the first and second tanks T1 and T2 to each other.

[0050] Natural convection may occur due to thermal imbalance between the first and second tanks T1 and T2, and for example, natural convection in the first tank T1 and natural convection in the second tank T2 may occur in opposite directions like clockwise and counterclockwise circulations and may meet and mix with each other at the first bent portions B1. For example, in the cavities C extending through the first and second tanks T1 and T2, one flow may be formed by natural convection, or circulations may be formed in opposite directions by natural convection and may meet and mix with each other at the first bent portions B1.

[0051] The cavities C extending through the first and second tanks T1 and T2 are filled with the first cooling medium F1, and thermal imbalance may occur in the cavities C according to the distances from the electrode terminals 15 at which heat is intensively generated such that the first cooling medium F1 may directly transfer heat by natural convection. For example, heat may transfer between the first and second tanks T1 and T2 by natural convection in the cavities C extending through the first and second tanks T1 and T2. That is, heat may transfer from the first tanks T1 to the second tanks T2, and thus heat may transfer from the terminal surfaces 10U through the first and second tanks T1 and T2 to the third tank T3 which is thermally connected to the second tanks T2 such that the heat may be finally dissipated to the outside of the battery pack through the third tank T3.

[0052] The second tanks T2 may extend from upper positions PU close to the first tanks T1 to lower positions PL close to the third tank T3. In this case, the cavities C of the second tanks T2 may have a width W2 (refer to FIG. 5) that gradually decreases from the upper positions PU to the lower positions PL. Here, the width W2 of the cavities C of the second tanks T2 may be measured in a direction perpendicular to the lateral surfaces 10S of the battery cells 10 facing the second tanks T2.

[0053] The second tanks T2 may be arranged to face the lateral surfaces 10S of the battery cells 10, and may have inner walls SI facing the battery cells 10 and outer walls SO which are opposite the battery cells 10, wherein the width between the inner walls SI and the outer walls SO of the second tanks T2 may be uniform from the upper positions PU to the lower positions PL. Here, the width of the second tanks T2 may be measured in a direction perpendicular to the lateral surfaces 10S of the battery cells 10 facing the second tanks T2.

[0054] The second tanks T2 may have a uniform width from the upper positions PU to the lower positions PL, and the cavities C formed in the second tanks T2 may have a width W2 which gradually decreases in a direction from the upper positions PU to the lower positions PL. This structure may be formed by adjusting a first thickness A1 (refer to FIG. 5) between the inner walls SI and the cavities C of the second tanks T2 to be uniformly thin to bring the cavities C of the second tanks T2 as close as possible to the battery cells 10 (more specifically, the lateral surfaces 10S of the battery cells 10), and adjusting a second thickness A2 (refer to FIG. 5) between the outer walls SO and the cavities C of the second tanks T2 to gradually increase from the upper positions PU to the lower positions PL for varying the width W2 of the cavities C in a direction from the upper positions PU to the lower positions PL.

[0055] For example, the cavity C of each of the second tanks T2 may have a right-angled triangular cross-section, and as the hypotenuse of the right-angled triangular cross-section obliquely extends in a direction from a vertex located at the upper position PU to a vertex located at the lower positions PL, the width W2 of the cavity C may gradually decrease. The first cooling medium F1 may be filled in the cavities C, and since the width W2 of the cavities C are designed to be different at the upper positions PU and the lower positions PL, the volume of the first cooling medium F1 filled in the cavities C may be differentially changed. That is, the volume of the first cooling medium F1 may change from a maximum value to a minimum value in a direction from the upper positions PU to the lower positions PL, and in the manner, the volume of the first cooling medium F1 may be differentially designed according to the amounts of heat to be dissipated at different positions.

[0056] Heat may be relatively intensively generated in the electrode terminals 15 of the battery cells 10 in which charge-discharge currents is concentrated. By considering this, heat may be differentially dissipated from the upper positions PU close to the electrode terminals 15 by adjusting the width W2 of the cavities C of the second tanks T2 to be relatively great at the upper positions PU. That is, the upper positions PU at which the need for heat dissipation is relatively great may face a relatively great width W2 of the cavities C and may thus face the maximum volume of the first cooling medium F1. In addition, the lower positions PL at which the need for heat dissipation is relatively low may face a relatively small width W2 of the cavities C and may thus face the minimum volume of the first cooling medium F1.

[0057] The cavities C may extend through the first and second tanks T1 and T2 and may have different shapes in the first and second tanks T1 and T2. That is, the cavities C of the first tanks T1 may have a uniform width W1 from the inner positions PI relatively close to the electrode terminals 15 to the outer positions PO relatively distant from the electrode terminals 15. The cavities of the first tanks T1 facing the terminal surfaces 10U may have a uniform width W1 such that the first cooling medium F1 may be provided in a sufficient amount for the terminal surfaces 10U having a relatively high heat dissipation demand. When the cavities C of the first tanks T1 have a nonuniform width W1, since the first tanks T1 have a relatively small length covering outer regions of the terminal surfaces 10U, the amount of the first cooling medium F1 may be insufficient at some positions to result in poor heat dissipation. Thus, the cavities C of the first tanks T1 may be formed to have a uniform width W1.

[0058] The width W2 of the cavities C of the second tanks T2 may be relatively great at the upper positions PU at which the heat dissipation demand is concentrated and may be relatively small at the lower positions PL at which the heat dissipation demand is relatively low, and thus, the volume of the first cooling medium F1 may be differentially designed according to the width W2 of the cavities C which varies from the upper positions to the lower positions PL for efficient distribution of the first cooling medium F1 in accordance with the heat dissipation demand.

[0059] The cavities C extending through the first and second tanks T1 and T2 are fluidically isolated, and the first cooling medium F1 is filled in the cavities C. The expression "the cavities C are fluidically isolated" may mean that each of the cavities C is not provided with a structure such as a duct for allowing the introduction and discharge of a fluid. That is, the cavities C may be fluidically isolated, and the first cooling medium F1 may be statically filled in the cavities C without any flow of the first cooling medium F1 into or out of the cavities C. The cavities C extending through the first and second tanks T1 and T2 may be fluidically isolated from the surrounding environment without fluidical connection with the surrounding environment, that is, without any flow of a fluid into or out of the cavities C.

[0060] The expression "the cavities C of the first and second tanks T1 and T2 are fluidically isolated" does not mean that the first and second tanks T1 and T2 are thermally insulated from the surrounding environment, and as described later, the first and second tanks T1 and T2 are thermally connected to the third tank T3 such that the first and second tanks T1 and T2 may exchange heat with the third tank T3 through heat conduction blocks CB. For example, the first and second tanks T1 and T2 are not fluidically connected to the third tank T3, and thus direct convection for heat transfer does not occur therebetween. However, since the first and second tanks T1 and T2 are thermally connected to the third tank T3 through the heat conduction blocks CB, heat transfer may occur therebetween by conduction. As described later, since the heat conduction blocks CB are provided between the first cooling medium F1 of the first and second tanks T1 and T2 and the second cooling medium F2 of the third tank T3, heat transfer may occur between the first and second cooling media F1 and F2, and heat transferred from the first cooling medium F1 may be dissipated to the outside of the battery pack through the second cooling medium F2 by convection forced by a fluid pump (not shown).

[0061] Natural convection may occur in the cavities C due to thermal imbalance, and the first cooling medium F1 may naturally convect at a low flow speed or may absorb heat in a stationary state in which the flow speed of the first cooling medium F1 is almost zero. As described above, in the cavities C, the first cooling medium F1 naturally convects at a low flow speed or absorbs heat in a stationary state in which the flow speed of the first cooling medium F1 is almost zero, and thus it is preferable that a fluid having a high heat capacity be used as the first cooling medium F1. As described later, the first cooling medium F1 of the first and second tanks T1 and T2 may be a fluid having a heat capacity greater than the heat capacity of the second cooling medium F2 of the third tank T3. This will be described in more detail later.

[0062] The first cooling medium F1 does not flow into or out of the cavities C and is not forced to convect by a fluid pump, but is simply contained in the cavities C in a static state. That is, it is not needed to provide the first and second tanks T1 and T2 with a duct structure for allowing the first cooling medium F1 to flow into or out of the cavities C, or a device such as a fluid pump for forcing the first cooling medium F1 to convect, and thus a simple fluid cooling structure may be provided using the first cooling medium F1.

[0063] Since the first and second tanks T1 and T2 in which the first cooling medium F1 is stored are arranged at positions closer to the electrode terminals 15 than the third tank T3 is to the electrode terminals 15, when the first and second tanks T1 and T2 adjacent to the electrode terminals 15 are provided with a structure such as a duct structure or a fluid pump, the possibility of leakage of the first cooling medium F1 stored in the first and second tanks T1 and T2 may increase. When the first cooling medium F1 leaks toward the electrode terminals 15 at which charge-discharge current is concentrated, the possibility of accidents such as an electrical short circuit may increase. Thus, in the present disclosure, fluid cooling is implemented using the first cooling medium F1 having a relatively high heat capacity to efficiently dissipate heat from the electrode terminals 15 having a relatively high heat dissipation demand, but the first and second tanks T1 and T2 storing the first cooling medium F1 are not provided with a duct for introduction or discharge of the first cooling medium F1 or a fluid pump for forcing the first cooling medium F1 to convent so as to prevent leakage of the first cooling medium F1 to the electrode terminals 15, such that the first cooling medium F1 may dissipate heat from the electrode terminals 15 while the first cooling medium F1 naturally convects or absorbs heat at a low flow speed.

[0064] The first cooling medium F1 may be a fluid which has a high heat capacity and is electrically insulative. The first cooling medium F1 is filled in the cavities C of the first and second tanks T1 and T2 which are close to the electrode terminals 15. In this case, in the process of injecting the first cooling medium F1 into the cavities C of the first and second tanks T1 and T2, the first cooling medium F1 may leak toward the electrode terminals 15, and when the first cooling medium F1 leaking toward the electrode terminals 15 accumulates on the terminal surfaces 10U, an electrical short circuit may occur between the electrode terminals 15 and other conductive members. Thus, it is preferable that the first cooling medium F1 be electrically insulative. For example, the first cooling medium F1 may be a fluid which is more electrically insulative than the second cooling medium F2 of the third tank T3 which is relatively distant from the electrode terminals 15, and for example, the first cooling medium F1 may be a fluid having electrical conductivity lower than that of the second cooling medium F2.

[0065] The third tank T3 may be arranged to face the bottom surfaces 10L of the battery cells 10. The third tank T3 may extend through the second bent portions B2 from the second tanks T2 facing the lateral surfaces 10S of the battery cells 10 to face the bottom surfaces 10L of the battery cells 10. The third tank T3 may be arranged to face the bottom surfaces 10L of the battery cells 10 and may dissipate heat from the bottom surfaces 10L of the battery cells 10 at a close distance from the bottom surfaces 10L of the battery cells 10.

[0066] A flow path D for receiving the flow of the second cooling medium F2 different from the first cooling medium F1 may be formed in the third tank T3. The flow path D of the third tank T3 is isolated from the cavities C extending through the first and second tanks T1 and T2 without fluidical connection with the cavities C. That is, the flow path D of the third tank T3 may contain a fluid different from a fluid contained in the cavities C of the first and second tanks T1 and T2, that is, the second cooling medium F2 different from the first cooling medium F1 of the first and second tanks T1 and T2, and the first and second cooling media F1 and F2 may be isolated from each other without being mixed with each other for dissipating heat from different regions of the battery pack. For example, the cavities C extending through the first and second tanks T1 and T2 may be fluidically isolated from the outside of the cavities C without fluidical connection with the third tank T3.

[0067] The cavities C extending through the first and second tanks T1 and T2 is not fluidically connected to the flow path D of the third tank T3, but the first and second tanks T1 and T2 are thermally connected to the third tank T3 such that heat may transfer between the first cooling medium F1 of the first and second tanks T1 and T2 and the second cooling medium F2 of the third tank T3 through the heat conduction blocks CB. For example, the heat conduction blocks CB may be formed between the cavities C extending through the first and second tanks T1 and T2 and the flow path D of the third tank T3 as metal blocks having no fluid-containing space. For example, the heat conduction blocks CB may include solid portions of the second tanks T2 in which the cavities C are not formed, and solid portions of the third tank T3 in which the flow path D is not formed.

[0068] The heat conduction blocks CB may include the second bent portions B2 which connect the second and third tanks T2 and T3 to each other. The second bent portions B2 may connect the second and third tanks T2 and T3 to each other such that the second tanks T2 facing the lateral surfaces 10S of the battery cells 10 may be connected to the third tank T3 facing the bottom surfaces 10L of the battery cells 10 through the second bent portions B2, and the second and third tanks T2 and T3 may extend from the second bent portions B2 in different directions to respectively face the lateral surfaces 10S and the bottom surfaces 10L of the battery cells 10.

[0069] Heat transfer between the second and third tanks T2 and T3 occurs through the heat conduction blocks CB and is thus different from heat transfer between the first and second tanks T1 and T2 which occurs by natural convection. That is, since the second and third tanks T2 and T3 are not fluidically connected to each other, convection heat transfer does not occur between the second and third tanks T2 and T3, but heat transfer occurs between the second and third tanks T2 and T3 through the heat conduction blocks CB which thermally connect the second and third tanks T2 and T3 to each other. That is, the first cooling medium F1 of the second tank T2 and the second cooling medium F2 of the third tank T3 do not come into direct contact with each other or mix with each other, but heat transfer may occur between the first cooling medium F1 and the second cooling medium F2 by conduction through the heat conduction blocks CB.

[0070] The third tank T3 may include the flow path D through which the second cooling medium F2 flows, and the second cooling medium F2 may be forced to flow at a certain flow speed by a fluid pump (not shown) such that heat transferred from the second tanks T2 or the bottom surfaces 10L of the battery cells 10 may be dissipated to the outside of the battery pack.

[0071] It is preferable that the second cooling medium F2 be a fluid having a relatively high heat capacity for cooling efficiency. That is, it is preferable that both the first cooling medium F1 of the first and second tanks T1 and T2 and the second cooling medium F2 of the third tank T3 be fluids having relatively high heat capacities. Since the first cooling medium F1 transfers heat while naturally convecting at a low flow speed in the cavities C of the first and second tanks T1 and T2 or absorbing heat in the cavities C of the first and second tanks T1 and T2 in a stationary state in which the flow speed of the first cooling medium F1 is almost zero, it is preferable that the first cooling medium F1 be a fluid having a relatively high heat capacity, and since the second cooling medium F2 is forced to flow at a controlled flow speed by the fluid pump, the flow speed of the second cooling medium F2 may be adjusted according to the heat dissipation demand such that the second cooling medium F2 may be a fluid having a heat capacity lower than that of the first cooling medium F1. For example, the average flow speed of the first cooling medium F1 may be less than the average flow speed of the second cooling medium F2, and the first cooling medium F1 may be a fluid having a heat capacity greater than that of the second cooling medium F2 to compensate for a cooling efficiency decrease caused by the flow speed difference.

[0072] Since the third tank T3 is arranged at a position more distant from the electrode terminals 15 than the first and second tanks T1 and T2 are from the electrode terminals 15, the possibility of leakage of the second cooling medium F2 to the electrode terminals 15 is relatively low. Therefore, the second cooling medium F2 may be a fluid less electrically insulative than the first cooling medium F1. That is, the second cooling medium F2 may be a fluid having relatively low heat capacity and electrical insulative characteristics compared to the first cooling medium F1. For example, the second cooling medium F2 may be a fluid such as water which is inexpensive compared to the first cooling medium F1.

[0073] The second cooling medium F2 may flow in the flow path D of the third tank T3, and the third tank T3 may include an inlet/outlet IO for introducing the second cooling medium F2 having a low temperature or discharging the second cooling medium F2 having a high temperature. The second cooling medium F2 may circulate along a closed loop path including the flow path D of the third tank T3 or an open loop path including the flow path D of the third tank T3, and in the closed loop path along which the second cooling medium F2 circulates, a cooling unit (not shown) may be provided to cool the second cooling medium F2.

[0074] The first, second, and third tanks T1, T2, and T3 may be formed of a metallic material which has high thermal conductivity and high formability for forming spaces for storing fluids such as the cavities C or the flow path D in the first, second, and third tanks T1, T2, and T3. The first, second, and third tanks T1, T2, and T3 may surround four different surfaces 10U, 10S, and 10L of each of the battery cells 10, and may be formed of a metallic material having high heat conductivity for efficient heat transfer from the battery cells 10 to the first and second cooling media F1 and F2. For example, the first, second, and third tanks T1, T2, and T3 may be formed of an aluminum material.

[0075] The first, second, and third tanks T1, T2, and T3 may be formed in one piece, and the second tanks T2 connected through the second bent portions B2 to the third tanks T3 facing the bottom surfaces 10L of the battery cells 10 may be provided as a pair facing each other and may face the lateral surfaces 10S of the battery cells 10. In addition, the first tanks T1 connected the through the first bent portions B1 to the second tanks T2 facing the lateral surfaces 10S of the battery cells 10 may be provided as a pair and may face the terminal surfaces 10U of the battery cells 10.

[0076] While embodiments of the present disclosure have been described with reference to the accompanying drawings, the embodiments are for illustrative purposes only, and it will be understood by those of ordinary skill in the art that various modifications may be made therefrom. Therefore, the scope of the present disclosure is defined by the claims.

INDUSTRIAL APPLICABILITY

[0077] The present disclosure may be applied to battery packs which are rechargeable energy sources, and to various devices using battery packs as power sources.

Claims

1. A battery pack comprising:

a battery cell (10) comprising a terminal surface (10U) on which an electrode terminal (15) is formed, a bottom surface (10L) which is opposite the terminal surface (10U), and a lateral surface (10S) which is between the terminal surface (10U) and the bottom surface (10L);
a first tank (T1) which faces the terminal surface (10U) of the battery cell (10);
a second tank (T2) which extends from the first tank (T1) and faces the lateral surface (10S) of the battery cell (10); and
a third tank (T3) which extends from the second tank (T2) and faces the bottom surface (10L) of the battery cell (10),
wherein a cavity (C) is formed in the first and second tanks (T1, T2) to extend across the first and second tanks (T1, T2), and the cavity (C) is filled with a first cooling medium (F1) and is fluidically isolated from outside of the battery pack, and
a flow path (D) is formed in the third tank (T3) to receive a flow of a second cooling medium (F2) which is different from the first cooling medium (F1).

2. A battery pack according to claim 1, wherein the cavity (C) extends through a boundary region between the first and second tanks (T1, T2) to allow a fluid to flow between the first and second tanks (T1, T2).

3. A battery pack according to claim 1 or claim 2, wherein the cavity (C) of the first and second tanks (T1, T2) and the flow path (D) of the third tank (T3) are isolated from each other.

4. A battery pack according to any one of claims 1 to 3, wherein a heat conduction block (CB) is provided between the cavity (C) of the first and second tanks (T1, T2) and the flow path (D) of the third tank (T3), optionally wherein the heat conduction block (CB) is not provided with a space for storing a fluid.

5. A battery pack according to any one of claims 1 to 4, wherein an inlet for introducing the second cooling medium (F2) and an outlet for discharging the second cooling medium (F2) are formed in the third tank (T3).

6. A battery pack according to any one of claims 1 to 5, wherein an average flow speed of the first cooling medium (F1) is less than an average flow speed of the second cooling medium (F2).

7. A battery pack according to any one of claims 1 to 6, wherein the first cooling medium (F1) has a heat capacity greater than a heat capacity of the second cooling medium (F2).

8. A battery pack according to any one of claims 1 to 7, wherein the first and second tanks (T1, T2) are connected to each other through a first bent portion (B1) and extend in different directions from the first bent portion (B1) to respectively face the terminal surface (10U) and the lateral surface (10S) of the battery cell (10), optionally wherein the cavity (C) extends through the first bent portion (B1) and fluidically connects the first and second tanks (T1, T2) to each other.

9. A battery pack according to any one of claims 1 to 8, wherein the second and third tanks (T2, T3) are connected to each other through a second bent portion (B2) and extend in different directions from the second bent portion (B2) to respectively face the lateral surface (10S) and the bottom surface (10L) of the battery cell (10), optionally wherein a heat conduction block (CB) is provided between the cavity (C) of the second tank (T2) and the flow path (D) of the third tank (T3), and the heat conduction block (CB) comprises the second bent portion (B2) and extends across the second bent portion (B2).

10. A battery pack according to any one of claims 1 to 9, wherein the first tank (T1) is formed in a region outside a pair of electrode terminals (15).

11. A battery pack according to any one of claims 1 to 10, wherein the cavity (C) has a width which is uniform in the first tank (T1) and is nonuniform in the second tank (T2).

12. A battery pack according to claim 11, wherein the width (W2) of the cavity (C) gradually decreases from an upper position (PU) of the second tank (T2) which is close to the first tank (T1) toward a lower position (PL) of the second tank (T2) which is close to the third tank (T3).

13. A battery pack according to claim 12, wherein the second tank (T2) comprises an inner wall (SI) facing the lateral surface (10S) of the battery cell (10) and an outer wall (SO) which is opposite the lateral surface (10S) of the battery cell (10), and
a thickness of the second tank (T2) which is defined between the inner wall (SI) and the outer wall (SO) is constant from the upper position (PU) close to the first tank (T1) to the lower position (PL) close to the third tank (T3).

14. A battery pack according to claim 13, wherein a first thickness (A1) defined between the cavity (C) and the inner wall (SI) is constant from the upper position (PU) close to the first tank (T1) to the lower position (PL) close to the third tank (T3), and
a second thickness (A2) defined between the cavity (C) and the outer wall (SO) gradually increases from the upper position (PU) close to the first tank (T1) to the lower position (PL) close to the third tank (T3), optionally wherein the cavity (C) of the second tank (T2) has a triangular cross-section with a hypotenuse which obliquely extends from a vertex located at the upper position (PU) close to the first tank (T1) to a vertex located at the lower position (PL) close to the third tank (T3) such that the width (W2) of the cavity (C) gradually decreases from the upper position (PU) to the lower position (PL).

15. A battery pack according to any one of claims 1 to 14, wherein the first to third tanks (T1, T2, T3) extend as one part.

Patentansprüche

1. Batteriepack, umfassend:

eine Batteriezelle (10), umfassend eine Anschlussfläche (10U), auf der ein Elektrodenanschluss (15) ausgebildet ist, eine Bodenfläche (10L), die der Anschlussfläche (10U) gegenüberliegt, und eine Seitenfläche (103), die zwischen der Anschlussfläche (10U) und der Bodenfläche (10L) liegt;
einen ersten Tank (T1), welcher der Anschlussfläche (10U) der Batteriezelle (10) zugewandt ist,
einen zweiten Tank (T2), der sich vom ersten Tank (T1) aus erstreckt und der Seitenfläche (108) der Batteriezelle (10) zugewandt ist, und
einen dritten Tank (T3), der sich vom zweiten Tank (T2) aus erstreckt und der Bodenfläche (10L) der Batteriezelle (10) zugewandt ist,
wobei ein Hohlraum (C) im ersten und im zweiten Tank (T1, T2) ausgebildet ist, um sich über den ersten und den zweiten Tank (T1, T2) zu erstrecken, und der Hohlraum (C) mit einem ersten Kühlmedium (F1) gefüllt ist und von der Außenseite des Batteriepacks fluidisch isoliert ist, und
ein Strömungsweg (D) im dritten Tank (T3) ausgebildet ist, um einen Strom eines zweiten Kühlmediums (F2) aufzunehmen, das vom ersten Kühlmedium (F1) verschieden ist.

2. Batteriepack nach Anspruch 1, wobei der Hohlraum (C) sich durch einen Grenzbereich zwischen dem ersten und dem zweiten Tank (T1, T2) erstreckt, um zu ermöglichen, dass ein Fluid zwischen dem ersten und dem zweiten Tank (T1, T2) fließt.

3. Batteriepack nach Anspruch 1 oder Anspruch 2, wobei der Hohlraum (C) des ersten und des zweiten Tanks (T1, T2) und der Strömungsweg (D) des dritten Tanks (T3) voneinander isoliert sind.

4. Batteriepack gemäß einem der Ansprüche 1 bis 3, wobei ein Wärmeleitungsblock (CB) zwischen dem Hohlraum (C) des ersten und des zweiten Tanks (T1, T2) und dem Strömungsweg (D) des dritten Tanks (T3) bereitgestellt ist, wobei optional der Wärmeleitungsblock (CB) nicht mit einem Raum zum Speichern eines Fluids versehen ist.

5. Batteriepack nach einem der Ansprüche 1 bis 4, wobei im dritten Tank (T3) ein Einlass zum Zuführen des zweiten Kühlmediums (F2) und ein Auslass zum Abführen des zweiten Kühlmediums (F2) ausgebildet sind.

6. Batteriepack nach einem der Ansprüche 1 bis 5, wobei eine mittlere Strömungsgeschwindigkeit des ersten Kühlmediums (F1) geringer als eine mittlere Strömungsgeschwindigkeit des zweiten Kühlmediums (F2) ist.

7. Batteriepack nach einem der Ansprüche 1 bis 6, wobei das erste Kühlmedium (F1) eine Wärmekapazität aufweist, die größer als eine Wärmekapazität des zweiten Kühlmediums (F2) ist.

8. Batteriepack nach einem der Ansprüche 1 bis 7, wobei der erste und der zweite Tank (T1, T2) durch einen ersten gebogenen Abschnitt (B1) miteinander verbunden sind und sich vom ersten gebogenen Abschnitt (B1) aus in unterschiedliche Richtungen erstrecken, um jeweils der Anschlussfläche (10U) und der Seitenfläche (10S) der Batteriezelle (10) zugewandt zu sein, wobei optional der Hohlraum (C) sich durch den ersten gebogenen Abschnitt (B1) erstreckt und den ersten und den zweiten Tank (T1, T2) fluidisch miteinander verbindet.

9. Batteriepack nach einem der Ansprüche 1 bis 8, wobei der zweite und der dritte Tank (T2, T3) durch einen zweiten gebogenen Abschnitt (B2) miteinander verbunden sind und sich vom zweiten gebogenen Abschnitt (B2) aus in unterschiedliche Richtungen erstrecken, um jeweils der Seitenfläche (10S) beziehungsweise der Bodenfläche (10L) der Batteriezelle (10) zugewandt zu sein, wobei optional ein Wärmeleitungsblock (CB) zwischen dem Hohlraum (C) des zweiten Tanks (T2) und dem Strömungsweg (D) des dritten Tanks (T3) bereitgestellt ist und der Wärmeleitungsblock (CB) den zweiten gebogenen Abschnitt (B2) umfasst und sich über den zweiten gebogenen Abschnitt (B2) hinweg erstreckt.

10. Batteriepack nach einem der Ansprüche 1 bis 9, wobei der erste Tank (T1) in einem Bereich außerhalb eines Paars von Elektrodenanschlüssen (15) ausgebildet ist.

11. Batteriepack nach einem der Ansprüche 1 bis 10, wobei der Hohlraum (C) eine Breite aufweist, die im ersten Tank (T1) gleichmäßig und im zweiten Tank (T2) ungleichmäßig ist.

12. Batteriepack nach Anspruch 11, wobei die Breite (W2) des Hohlraums (C) allmählich von einer oberen Position (PU) des zweiten Tanks (T2), die nahe dem ersten Tank (T1) ist, zu einer unteren Position (PL) des zweiten Tanks (T2), die nahe dem dritten Tank (T3) ist, abnimmt.

13. Batteriepack nach Anspruch 12, wobei der zweite Tank (T2) eine Innenwand (SI), die der Seitenfläche (10S) der Batteriezelle (10) zugewandt ist, und eine Außenwand (SO), die der Seitenfläche (10S) der Batteriezelle (10) gegenüberliegt, umfasst, und eine Dicke des zweiten Tanks (T2), die zwischen der Innenwand (SI) und der Außenwand (SO) definiert ist, von der oberen Position (PU) nahe dem ersten Tank (T1) bis zur unteren Position (PL) nahe dem dritten Tank (T3) konstant ist.

14. Batteriepack nach Anspruch 13, wobei eine erste Dicke (A1), die zwischen dem Hohlraum (C) und der Innenwand (SI) definiert ist, von der oberen Position (PU) nahe dem ersten Tank (T1) bis zur unteren Position (PL) nahe dem dritten Tank (T3) konstant ist, und
eine zweite Dicke (A2), die zwischen dem Hohlraum (C) und der Außenwand (SO) definiert ist, allmählich von der oberen Position (PU) in der Nähe des ersten Tanks (T1) zur unteren Position (PL) in der Nähe des dritten Tanks (T3) zunimmt, wobei optional der Hohlraum (C) des zweiten Tanks (T2) einen dreieckigen Querschnitt mit einer Hypotenuse aufweist, die sich schräg von einem Eckpunkt, der sich an der oberen Position (PU) nahe dem ersten Tank (T1) befindet, zu einem Eckpunkt, der sich an der unteren Position (PL) nahe dem dritten Tank (T3) befindet, erstreckt, sodass die Breite (W2) des Hohlraums (C) allmählich von der oberen Position (PU) zur unteren Position (PL) abnimmt.

15. Batteriepack nach einem der Ansprüche 1 bis 14, wobei der erste bis dritte Tank (T1, T2, T3) sich als ein Teil erstrecken.

Revendications

1. Bloc-batterie, comprenant :

une cellule de batterie (10) comprenant une surface terminale (10U) sur laquelle une borne d'électrode (15) est formée, une surface de fond (10L) qui est opposée à la surface terminale (10U), et une surface latérale (10S) qui est entre la surface terminale (10U) et la surface de fond (10L) ;
un premier réservoir (T1) qui fait face à la surface terminale (10U) de la cellule de batterie (10) ;
un deuxième réservoir (T2) qui s'étend du premier réservoir (T1) et fait face à la surface latérale (10S) de la cellule de batterie (10) ; et
un troisième réservoir (T3) qui s'étend du deuxième réservoir (T2) et fait face à la surface de fond (10L) de la cellule de batterie (10),
dans lequel une cavité (C) est formée dans les premier et deuxième réservoirs (T1, T2) pour s'étendre à travers les premier et deuxième réservoirs (T1, T2), et la cavité (C) est remplie d'un premier agent réfrigérant (F1) et est isolée d'une manière fluidique de l'extérieur du bloc-batterie,

et
un trajet d'écoulement (D) est formé dans le troisième réservoir (T3) pour recevoir un écoulement d'un deuxième agent réfrigérant (F2) qui est différent du premier agent réfrigérant (F1).

2. Bloc-batterie selon la revendication 1, dans lequel la cavité (C) s'étend à travers une zone limite entre les premier et deuxième réservoirs (T1, T2) pour permettre à un fluide de s'écouler entre les premier et deuxième réservoirs (T1, T2).

3. Bloc-batterie selon la revendication 1 ou la revendication 2, dans lequel la cavité (C) des premier et deuxième réservoirs (T1, T2) et le trajet d'écoulement (D) du troisième réservoir (T3) sont isolés l'un de l'autre.

4. Bloc-batterie selon l'une quelconque des revendications 1 à 3, dans lequel un bloc de conduction de chaleur (CB) est prévu entre la cavité (C) des premier et deuxième réservoirs (T1, T2) et le trajet d'écoulement (D) du troisième réservoir (T3), facultativement dans lequel le bloc de conduction de chaleur (CB) n'est pas prévu avec un espace pour stocker un fluide.

5. Bloc-batterie selon l'une quelconque des revendications 1 à 4, dans lequel une admission pour introduire le deuxième agent réfrigérant (F2) et une sortie pour décharger le deuxième agent réfrigérant (F2) sont formées dans le troisième réservoir (T3).

6. Bloc-batterie selon l'une quelconque des revendications 1 à 5, dans lequel une vitesse d'écoulement moyenne du premier agent réfrigérant (F1) est inférieure à une vitesse d'écoulement moyenne du deuxième agent réfrigérant (F2).

7. Bloc-batterie selon l'une quelconque des revendications 1 à 6, dans lequel le premier agent réfrigérant (F1) a une capacité calorifique supérieure à une capacité calorifique du deuxième agent réfrigérant (F2).

8. Bloc-batterie selon l'une quelconque des revendications 1 à 7, dans lequel les premier et deuxième réservoirs (T1, T2) sont raccordés l'un à l'autre par une première portion coudée (B1) et s'étendent dans différents sens de la première portion coudée (B1) pour faire face respectivement à la surface terminale (10U) et à la surface latérale (10S) de la cellule de batterie (10), facultativement dans lequel la cavité (C) s'étend à travers la première portion coudée (B1) et raccorde d'une manière fluidique les premier et deuxième réservoirs (T1, T2) l'un à l'autre.

9. Bloc-batterie selon l'une quelconque des revendications 1 à 8, dans lequel les deuxième et troisième réservoirs (T2, T3) sont raccordés l'un à l'autre par une deuxième portion coudée (B2) et s'étendent dans différents sens depuis la deuxième portion coudée (B2) pour faire face respectivement à la surface latérale (10S) et la surface de fond (10L) de la cellule de batterie (10), facultativement dans lequel un bloc de conduction de chaleur (CB) est prévu entre la cavité (C) du deuxième réservoir (T2) et le trajet d'écoulement (D) du troisième réservoir (T3), et le bloc de conduction de chaleur (CB) comprend la deuxième portion coudée (B2) et s'étend à travers la deuxième portion coudée (B2).

10. Bloc-batterie selon l'une quelconque des revendications 1 à 9, dans lequel le premier réservoir (T1) est formé dans une zone située à l'extérieur d'une paire de bornes d'électrode (15).

11. Bloc-batterie selon l'une quelconque des revendications 1 à 10, dans lequel la cavité (C) a une largeur qui est uniforme dans le premier réservoir (T1) et est non uniforme dans le deuxième réservoir (T2).

12. Bloc-batterie selon la revendication 11, dans lequel la largeur (W2) de la cavité (C) diminue progressivement depuis une position supérieure (PU) du deuxième réservoir (T2) qui est proche du premier réservoir (T1) vers une position inférieure (PL) du deuxième réservoir (T2) qui est proche du troisième réservoir (T3).

13. Bloc-batterie selon la revendication 12, dans lequel le deuxième réservoir (T2) comprend une paroi interne (SI) faisant face à la surface latérale (10S) de la cellule de batterie (10) et une paroi externe (SO) qui est opposée à la surface latérale (10S) de la cellule de batterie (10), et
une épaisseur du deuxième réservoir (T2) qui est définie entre la paroi interne (SI) et la paroi externe (SO) est constante de la position supérieure (PU) proche du premier réservoir (T1) à la position inférieure (PL) proche du troisième réservoir (T3).

14. Bloc-batterie selon la revendication 13, dans lequel une première épaisseur (A1) définie entre la cavité (C) et la paroi interne (SI) est constante de la position supérieure (PU) proche du premier réservoir (T1) à la position inférieure (PL) proche du troisième réservoir (T3), et
une deuxième épaisseur (A2) définie entre la cavité (C) et la paroi externe (SO) augmente progressivement depuis la position supérieure (PU) proche du premier réservoir (T1) à la position inférieure (PL) proche du troisième réservoir (T3), facultativement dans lequel la cavité (C) du deuxième réservoir (T2) a une section transversale triangulaire avec une hypoténuse qui s'étend obliquement d'un sommet situé

à la position supérieure (PU) proche du premier réservoir (T1) à un sommet situé à la position inférieure (PL) proche du troisième réservoir (T3) de telle sorte que la largeur (W2) de la cavité (C) diminue progressivement de la position supérieure (PU) à la position inférieure (PL).

15. Bloc-batterie selon l'une quelconque des revendications 1 à 14, dans lequel les premier au troisième réservoirs (T1, T2, T3) s'étendent en une seule partie.

FIG. 1

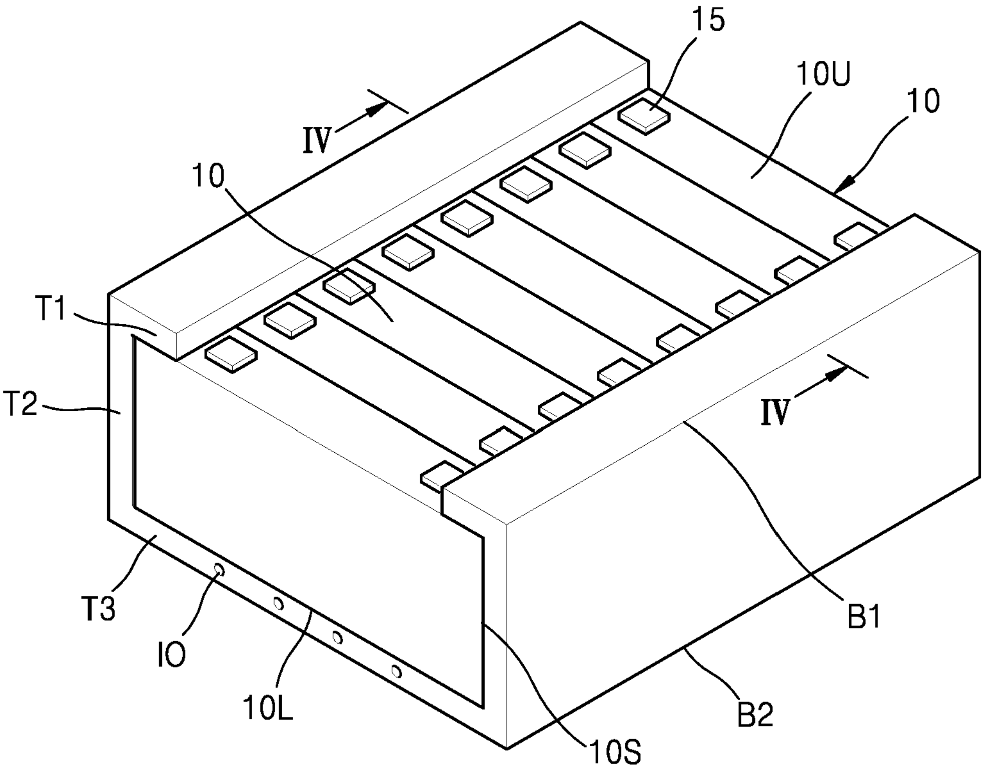


FIG. 2

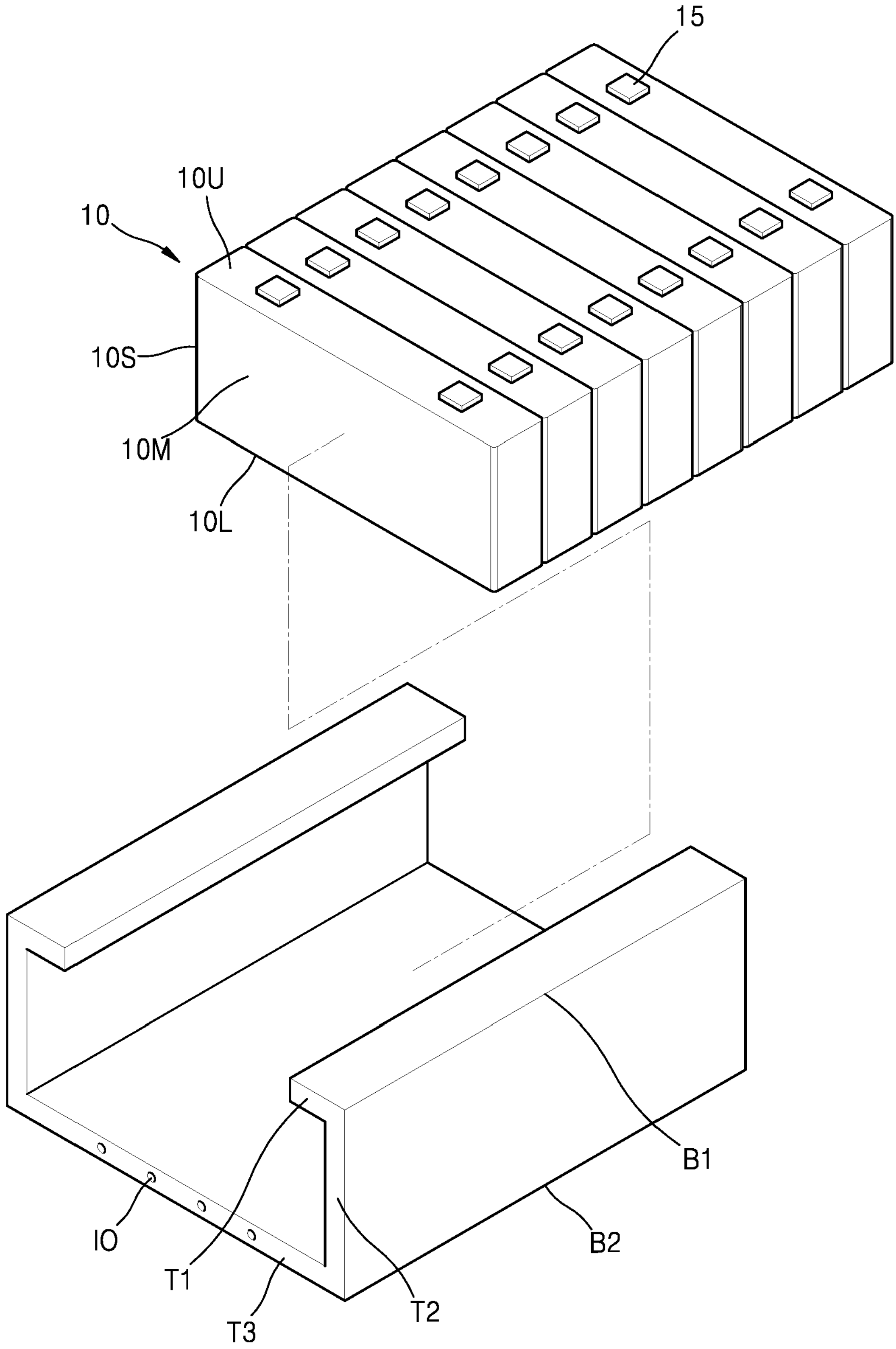


FIG. 3

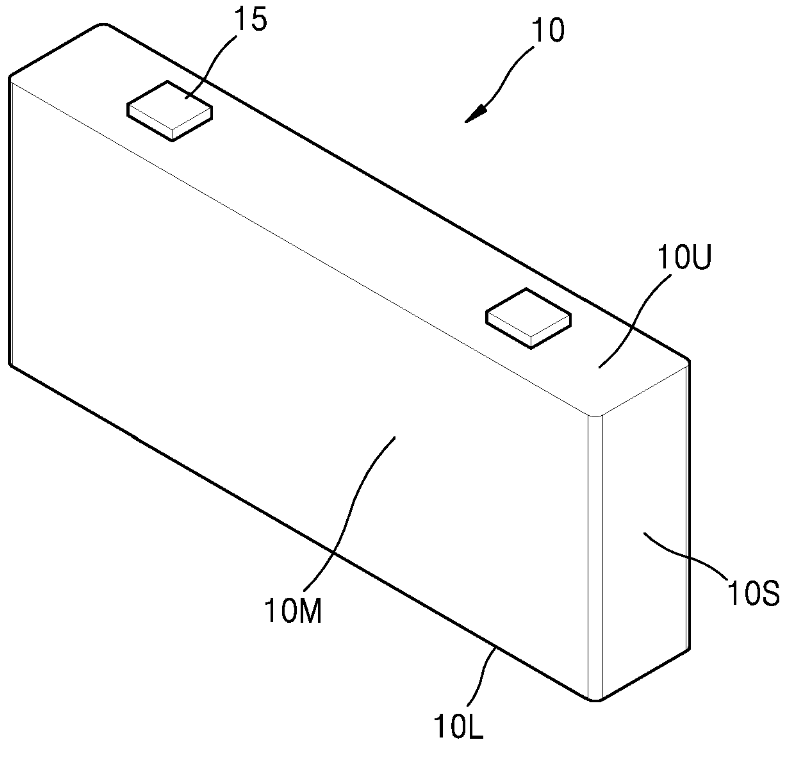


FIG. 4

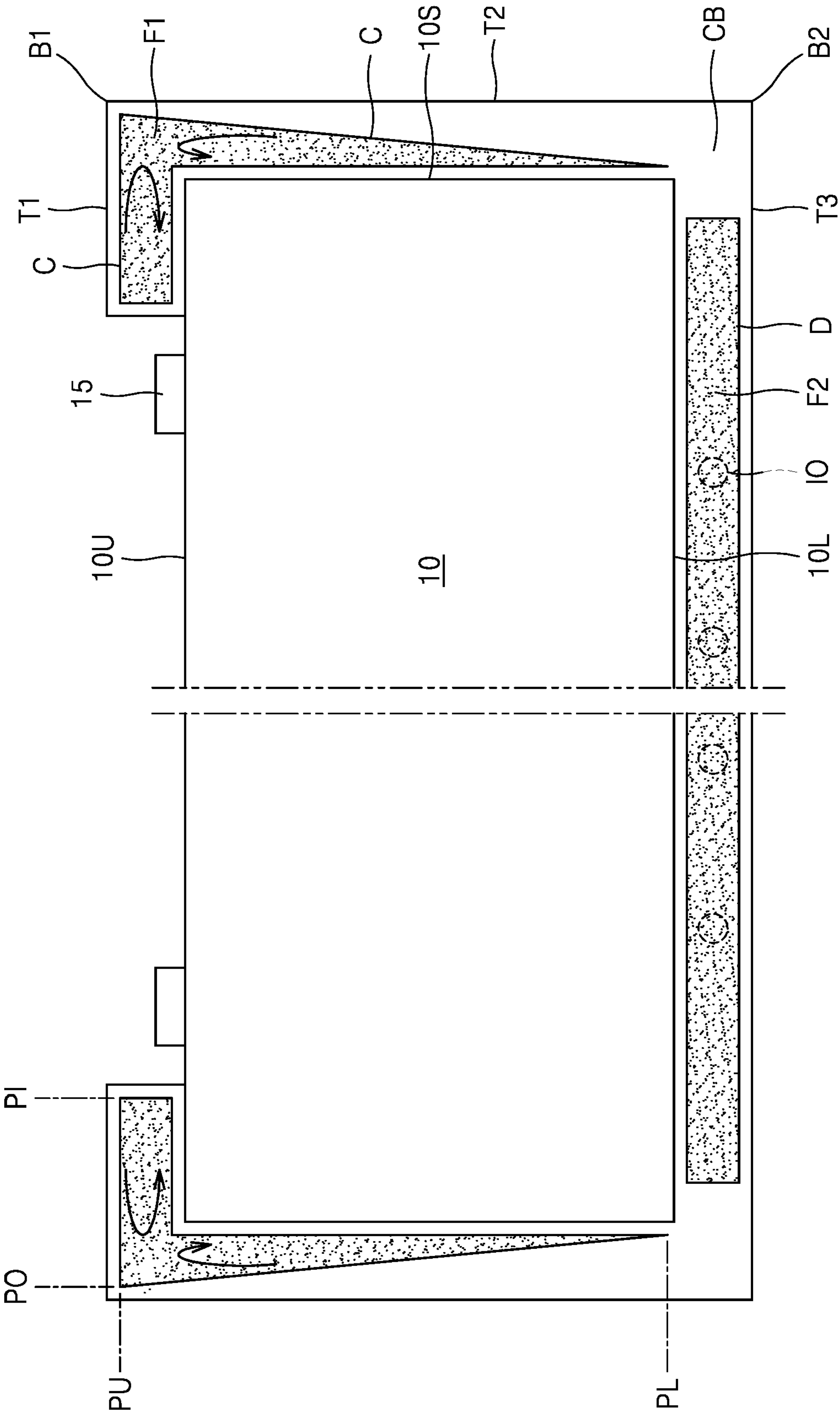
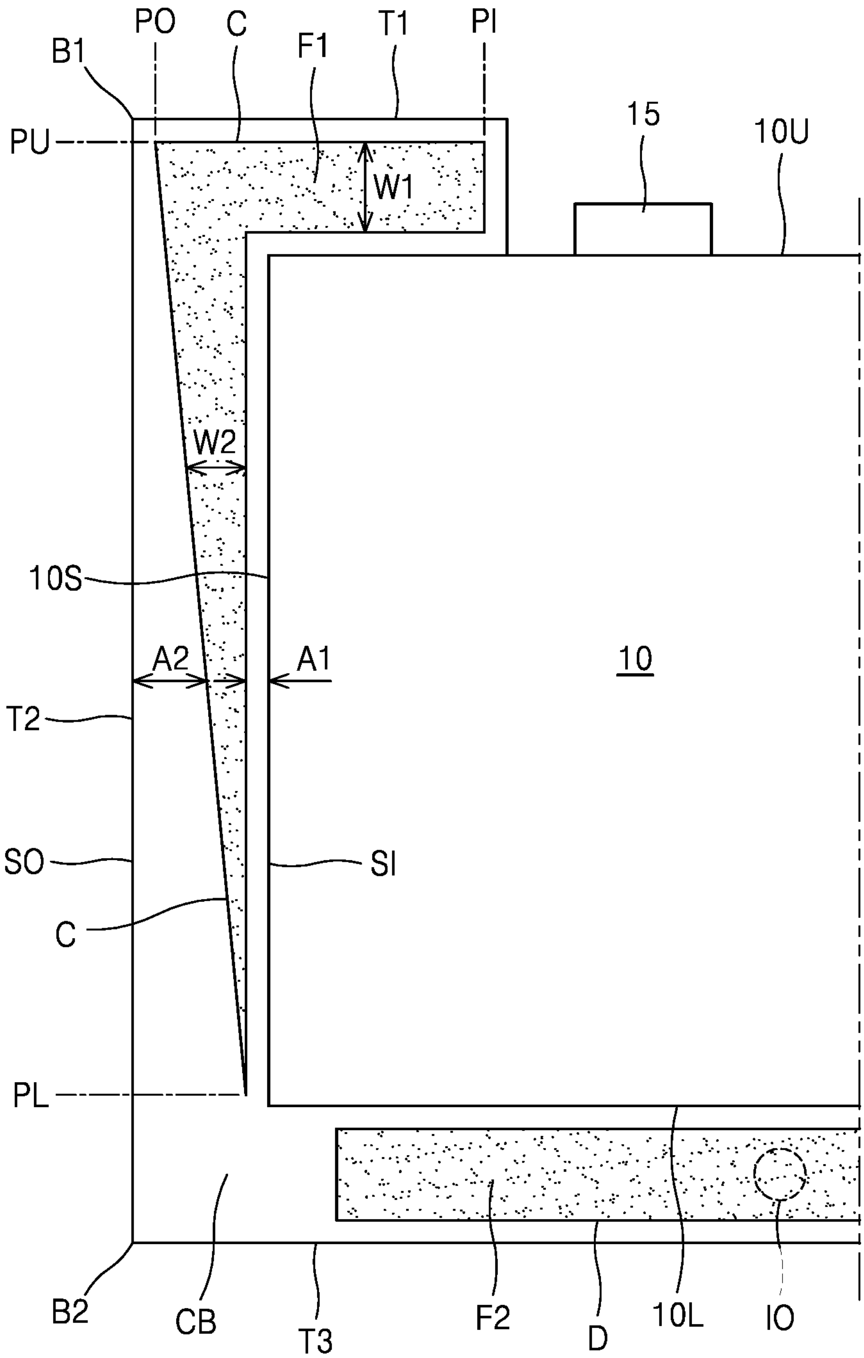


FIG. 5


B1
PO
C
F1
T1
PI
PU
W1
15
10U
W2
10S
A2
A1
10
T2
SO
SI
C
PL
B2
CB
T3
F2
D
10L
IO

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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